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NATIONAL DAM SAFETY PROGRAM. GREATER JOHNSTOWN WATER AUTHORITY --ETC(U)
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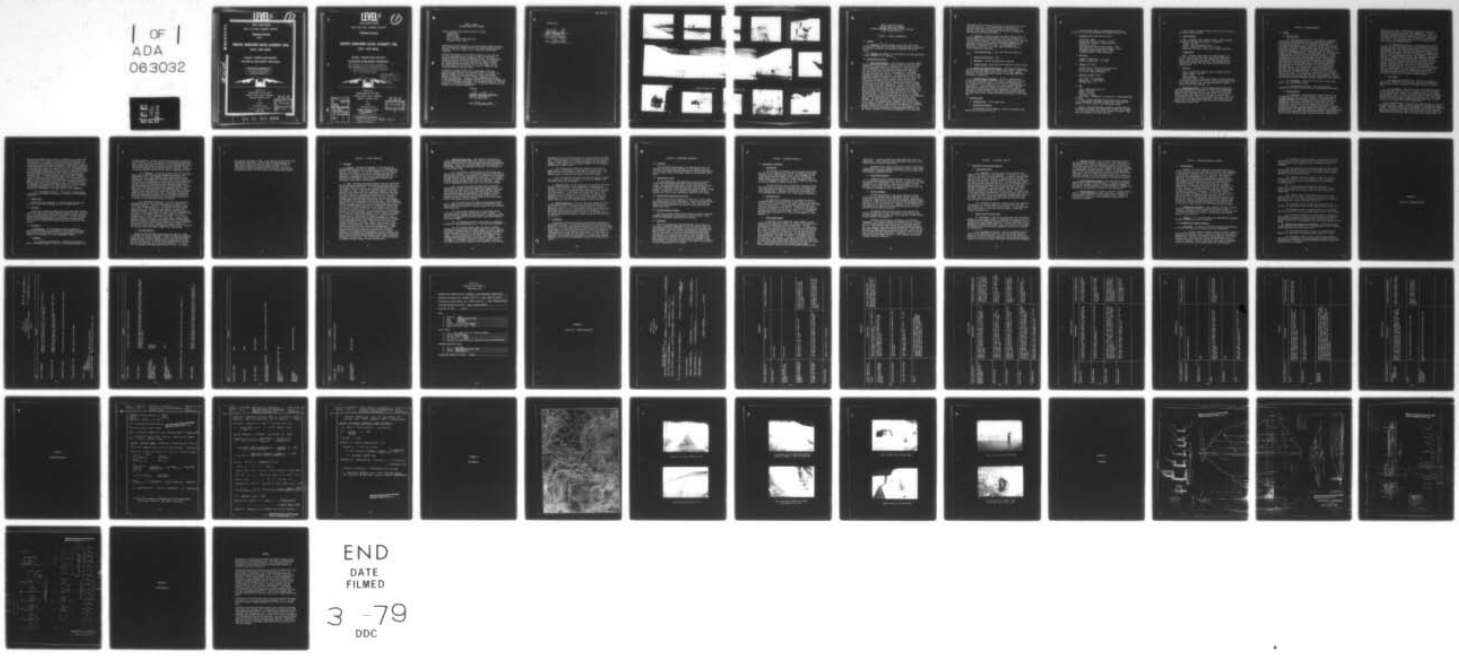

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OHIO RIVER BASIN

SALT LICK RUN, CAMBRIA COUNTY

PENNSYLVANIA

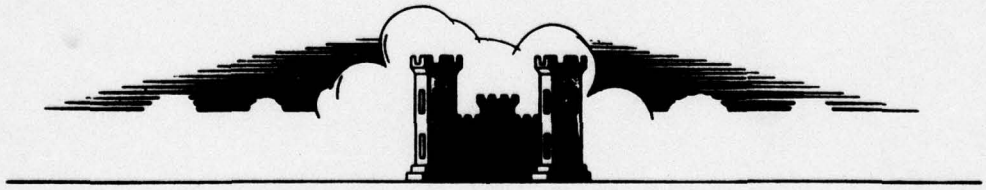
429

GREATER JOHNSTOWN WATER AUTHORITY DAM

(SALT LICK DAM)

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM



Prepared for

DEPARTMENT OF THE ARMY

Baltimore District, Corps of Engineers

Baltimore, Maryland 21203

By

EADS

1126 Eighth Avenue

Altoona, Pennsylvania 16602

JUNE 1978

LEVEL II

(1)

OHIO RIVER BASIN

SALT LICK RUN, CAMBRIA COUNTY

PENNSYLVANIA

GREATER JOHNSTOWN WATER AUTHORITY DAM

(SALT LICK DAM)

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

(6) National Dam Safety Program. Greater Johnstown Water Authority Dam-Salt Lick Dam (NDI-PA-429), Ohio River Basin, Salt Lick Run, Cambria County, Pennsylvania. Phase I Inspection Report.

(12) 57 p.

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PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Greater Johnstown Water Authority (Salt Lick Dam)
Pennsylvania
Cambria County
Salt Lick Run
April 4, 1978 (visual inspection)
Inspection Team - EADS

Based on the visual inspection of the dam and appurtenant structures, past performance of the dam, and the very limited engineering data available, the dam is judged to be in marginally satisfactory condition.

A significant weakness is the apparent inability of the spillway weir and downstream channel to pass one-half of the Probable Maximum Flood (PMF) without overtopping the dam. The owner should initiate a detailed hydrologic and hydraulic study to determine the maximum capacity of the spillway weir and channel and PMF. The study should be performed in the very near future. Should the study prove that the spillway is seriously inadequate, then corrective measures should be taken.

In addition, the owner should have a study made of the slope stability condition of the east abutment section of the dam. The observed seepage condition warrants this study. The sediment deposits observed in the tunnel indicates a migration of fines through the embankment. A study of this condition should be made in the immediate future. Piezometers should be installed in the dam and in the area immediately downstream. The instruments should be read regularly and if a significant change occurs in time, the effect on the embankment safety should be determined.

Approved:

Robert C. Tomlinson

Robert C. Tomlinson, P.E.
Vice President, EADS

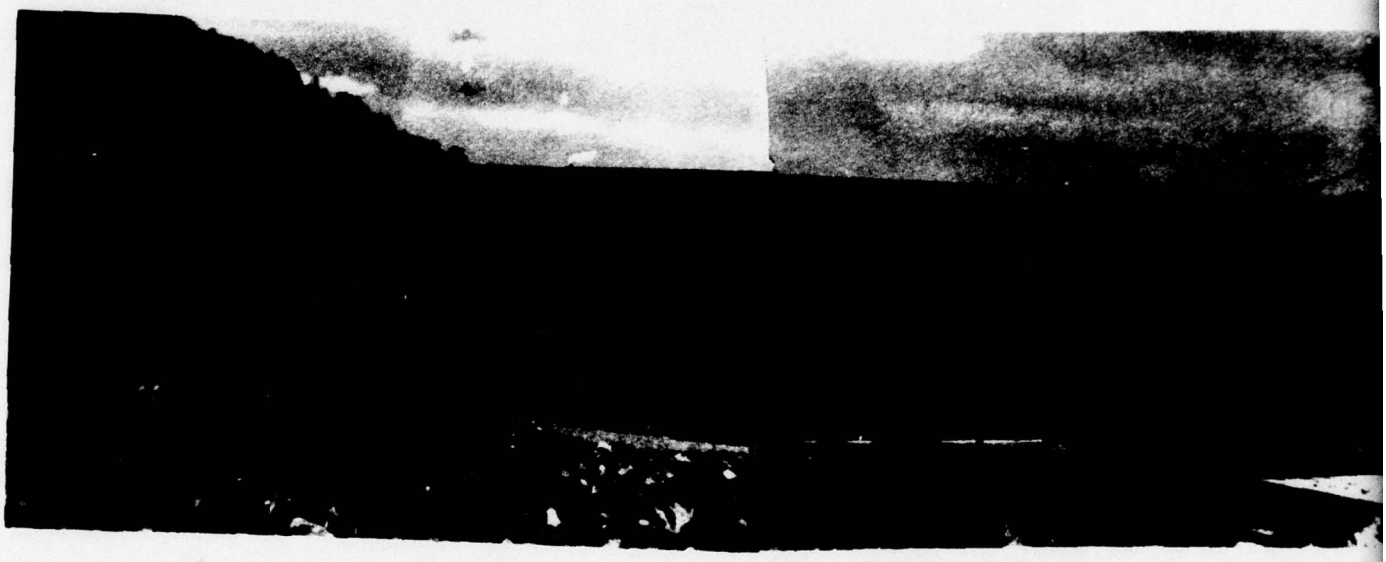
Date May 30, 1978

APPROVED BY:

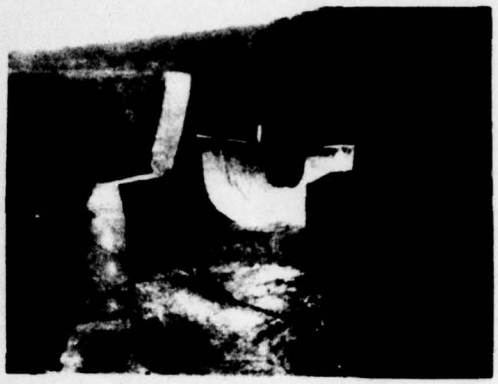
John H. Kenworthy

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

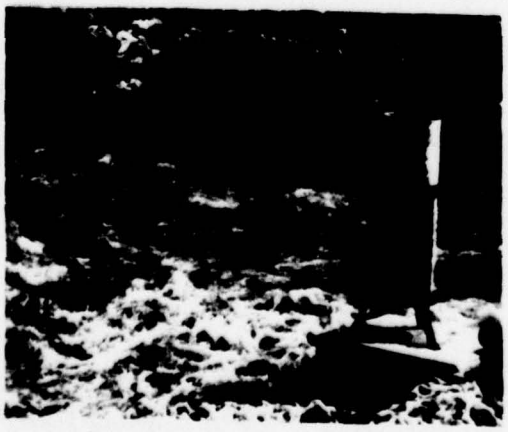
DATE: 14 June 1978



GENERAL OVERVIEW OF DAM



ERVIEW OF DAM



PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GREATER JOHNSTOWN WATER AUTHORITY-SALT LICK DAM
ID NO. PA 429 (PA 11-8)

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority: The Dam Inspection Act, Public Law 92-367 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of dam inspection throughout the United States.

b. Purpose: The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenance: Salt Lick Dam is an earthen embankment structure which contains a large sluiced silt and clay core extending to bedrock and for a distance of 11 feet on each side of its longitudinal centerline; and contains a concrete core wall that extends well into bedrock not only across the valley but also up onto each hillside. (See Appendix E - Drawings) The rock upon which the core wall is founded was core drilled and afterwards grouted under pressure. The downstream portion of the embankment contains a system of french drains near the toe of the slope and to the right of the original stream channel, which collects the drainage from the ground that was marshy prior to construction, as per dam records. These drains lead to a masonry covered sump at the toe of embankment. The dam is 835 feet long and 110 feet high, with a 20 foot crest width. The upstream slope which contains a berm 53 feet wide, 71 feet below the crest, has 3H to 1V slope, with a 12 inch thick hand-placed rock riprap. The downstream slope has 3H to 1V slopes with sod cover and surface drainage ditches. Flood flows discharge by way of a "U" shaped massive concrete weir which extends into the reservoir and discharges into a channel excavation out of bedrock in the left or east abutment. The spillway extends a few hundred feet along the hillside, then turns abruptly and discharged down the hillside to the valley to an outlet channel leading to the original channel. An oval shaped 10 feet x 9 feet conduit (See Appendix E - Drawings) extends through the dam a 160 feet from the right abutment, is 650 feet long and was designed to discharge about 2380 cubic feet per second. Encased in its concrete foundation is a 30 inch cast

iron supply line that can also be used as a blow-off line to drain down the reservoir. At the upstream end of the conduit is a concrete intake tower housing the supply piping and valves. A concrete valve house is constructed near the toe of the dam with metering and chlorination equipment.

b. Location: The dam is located in Cambria County, and lies several hundred feet above the mouth of Salt Lick Run with the Little Conemaugh River at Mineral Point, and about 7.0 miles upstream from the City of Johnstown. (See Location Map, Appendix D) The structure is shown on the Nanty Glo 7½ minute quadrangle sheet dated 1964 and photorevised in 1972. The coordinates are N40 22'56", E 78 50'05". The little town of Mineral Point is located immediately downstream.

c. Size Classification: Large (110 feet high, 2630 acre feet)

d. Hazard Classification: High

e. Ownership: Greater Johnstown Water Authority

f. Purpose of Dam: Water Supply for Johnstown, PA and vicinity

g. Design and Construction History: The dam was designed by the engineering department of the Cambria Steel Company in about 1908 and was constructed between 1909 and 1913 by the water company employees. No major modifications appear to have been made since the original construction.

h. Normal Operation Procedure: The lake is maintained at spillway elevation 1485.0 leaving 8.0 feet of freeboard to the top of the dam at elevation 1493.0. All inflow occurring when the pool elevation is at or above this weir level is discharged over the uncontrolled "U" shaped spillway at the east abutment. The only established procedure for operation of the dam is to maintain continuity of mine drainage cut-off ditches along the east abutment and above the lake, and control water quality by the use of one of the three intake valves located at different elevations in the intake tower.

1.3 Pertinent Data

a. Discharge Area: 11.92 square miles

b. Discharge at Damsite:

Maximum known flood at damsite - 6700 cfs (estimated from maximum pool elevation of 7-20-77)

Total spillway capacity at maximum pool elevation - 11,900 cfs (from records received from PennDER for elev. 1493)

c. Elevation (feet above mean sea level)

Top of dam - 1493
Maximum pool design surcharge - unknown
Maximum pool of record - 1490.5± (7-20-77)
Normal pool - 1485
Upstream portal invert outlet conduit - 1397±
Downstream portal invert outlet conduit - 1370 ±
Streambed at cernterline of dam - 1383±
Maximum tailwater - 1385± (estimated)

d. Reservoir

Length of maximum pool - 1.1 miles
Length of normal pool - 1.0 miles

e. Storage (acre-feet)

Spillway crest - 2630 (857 million gallons)
Design surcharge - 3052 (estimated)
Top of dam - 3190 (estimated)

f. Reservoir Surface (acres)

Top of dam - 76 (estimated)
Maximum Pool - 76 (estimated)
Spillway crest - 67

g. Dam

Type - puddle core earth fill
Length - 835 feet
Height - 110 feet
Top Width - 20 feet
Side slopes - upstream 3H to 1V with 35 ft. berm; downstream 3H to 1V.
Zoning - earthen embankment with puddled core on centerline of embankment, top width 10 feet at top of dam and side slopes of 1 on 3/4, with 12 inch hand-placed riprap.

Cutoff - Plans and dam reports indicate concrete core wall on centerline of dam, with a top width of 4 feet, and a height of 12 feet above puddle core ditch, bottom of core wall 7 feet thick and extends 6 to 18 feet into rock.

Grout curtain - foundation bedrock below core wall drilled and grouted under pressure.

h. Outlet Conduit:

Type - Irregular (oval shaped) 10 feet x 9 feet concrete with 30 inch cast iron pipe encased in foundation.
Length - 650 feet
Closure - 30 inch blow-off valve
Access - Steel truss bridge to intake tower.
Regulating facilities - gate valves, manually operated

i. Intake Tower:

Type - Concrete intake tower with inside diameter of 12 feet, with 18 inch thick walls and 3/8 inch steel shell liner. Tower includes 3-20 inch intake ports at 30 foot intervals to control water quality. Also includes 30-inch waste valve and pipe, with all valves controlled from the operating deck.

j. Spillway

Type - uncontrolled, bath-tub type "U"-shaped ogee weir
Length of weir - 140 feet
Crest - 1485.0
Upstream channel - none
Downstream channel - downstream channel partially repaired and restored after July 1977 flood. Remaining restoration work to be under contract soon, same being prepared by Gannett Fleming Corddry and Carpenter, Inc.

k. Regulating Outlets - The oval-shaped outlet conduit was constructed primarily for water control behind the dam embankment during the construction of the dam. It is now used as an access conduit to the intake tower or an outlet conduit for the 30-inch valve and waste line (blow-off) for drainage of and/or control of the pool elevation. There are no records as to when it was last used to drain or lower the pool elevation. The 30-inch cast iron supply line in the foundation of the conduit can also be used as an additional blow-off line.

SECTION 2 - ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and hydraulics: The amount of hydrologic and hydraulic data available for this project was very limited. In one of the files obtained from the Pennsylvania Department of Environmental Resources, a list of the water company dams and their statistics listed the discharge capacity of the spillway at 11,250 cubic feet per second. A construction report dated October 17, 1912 listed the drainage area of 11.5 square miles and the storage capacity of 857,000,000 gallons. The same report list the dimensions of the spillway, stating its maximum carrying capacity is 11,250 second feet, but does not state for what pool elevation. Further, it stated that the conduit was designed to carry the estimated flood discharge of the creek during construction, said discharge being 200 second feet per square mile. Undated hand computations were included in the DER files comparing the maximum discharge per square mile by the Mangan and the U. S. Army Pittsburgh and Baltimore Offices. For 12 square miles, the respective values were 940, 1780 and 1490 second feet. Additional computations indicated that a maximum discharge for a weir (not sharp crested) was 11,700 cfs with an 8 foot head, a coefficient of 3.7 and weir length of 140 feet. It is noted that an 8 foot head would raise the pool elevation to elevation 1493, the top of dam elevation. Further computations indicate the maximum spillway discharge at about 5360 cfs.

(2) Embankment: There were no data and/or design computations for the embankment design.

(3) Appurtenant Structures: There were no design computations for the structural design of the appurtenant structures.

b. Design Features

(1) Embankment: The construction drawings were only two in number and are to be "as built" drawings. These plans show an earthen embankment structure which contains a large puddle core extending to bedrock for a distance of 11 feet on each side of its longitudinal centerline; and includes a concrete core wall that extends well into bedrock, not only across the valley but also up onto each hillside. The rock upon which the core wall is founded was core drilled and afterwards grouted under pressure. The downstream portion of the embankment contains a system of french drains near the toe of the slope and to the right of the original stream channel which collects the drainage from the ground that was reported to be

marshy prior to start of construction. These drains lead to a masonry covered sump at the toe of the embankment. The dam is 835 feet long and 110 feet high, with a 20 foot crest width. The upstream slope which contains a berm 53 feet wide, 71 feet below the crest, has 3H to 1V slope, with a 12 inch thick hand-placed rock riprap. The downstream slope has 3H to 1V slope with sod cover and surface drainage ditches.

(2) Appurtenant Structures: The drawings show that the ogee weir and spillway channel are along and adjacent to the east abutment while the oval shaped outlet conduit is located along the west abutment toe. Both structures are founded on bedrock. The spillway weir extends out into the pool area and is a bathtub type weir for a total length of 140 feet. The depth and width of the bucket varies and discharges along the east abutment. The spillway east wall is bedrock except the small wall extending downstream from the cut-off wall at centerline of dam. The west spillway wall and bottom are concrete, with the spillway being cut out of bedrock. The oval shaped 10 foot high by 9 foot wide conduit extends through the dam 160 feet from the right abutment, is 650 feet long and contains a 30 inch cast iron blow-off and supply line in its foundation. At the upstream end of the conduit is a concrete outlet tower housing the supply piping and valves. A valve and chlorination building is constructed near the toe of the dam and extends into the conduit discharge channel.

c. Design Data

(1) Hydrology and Hydraulics: There were no reports or design data available for this dam other than the minimum amount of data obtained from the construction inspection reports in the DER files.

(2) Embankment: There were no soils and foundation reports or data available for this project. A "Report On The Salt Lick Dam Of The Johnstown Water Company" did include such data as the "trench was excavated in this fire clay rock about 6 feet in width and between 10 and 15 feet deep," with a core wall carried into rock. Holes were drilled into the rock about 12 feet apart and grouted under 60 pounds pressure so as to make the foundation impervious.

From a report included in the dam files, dated October 17, 1912 and written by Charles E. Ryder, Assistant Engineer of the Johnstown Water Company, the material composing the embankment was graded by the hydraulic process. The core of fine material was 10 feet wide on the crest and have slopes on either side of 4H to 5V except that on the upstream side between elevations 1420 and 1400, where the slope was made on 3H on 1V.

Between the upstream slope of this fine material and the water side of the dam the fill consists of stones grading from large ones on the dam slope, to the smaller size next to the fine material, the interstices between the stones being wholly filled with fine material. On the downstream side of the fine material, small stones mixed with fine material was placed to a slope of 1V on 1.5H, the outer portion of the embankment consisting of large and small stones without earthy material between. Below elevation 1420, however, the lower toe of the slope consisted of earth placed on a fill of large stone at elevation 1390. It is believed that owing to the small thickness of the fine material above elevation 1480 it will be necessary, in order to insure proper work and imperviousness, to place the clay by means of horses and carts and roll the fill. The entire surface of the upstream slope is being protected by means of hand-laid riprap. The drawings or records do not indicate the use of a filter blanket in the downstream portion of the dam; however, there is no indication of settlement on the lower portion of the embankment.

(3) Appurtenant Structures: There were no design values or calculations available for review with respect to the appurtenant structures.

2.2 Construction

Construction data available for review included only the two "as built" construction drawings and two inspection reports.

2.3 Operation

There were no records available concerning operational problems of the dam, other that the dam inspection reports included in the DER files. The dam operator reported that there were no major problems associated with the structure and its operation. He did state that the acid mine drainage ditches or piping along the eastern slopes of the reservoir did need some repairs which he was trying to take care of.

2.4 Evaluation

a. Availability: All the engineering data available was provided by the Pennsylvania Department of Environmental Resources, with minimal data being received from the dam operator, the water company or the managing firm, Laurel Management Company.

b. Adequacy

(1) Hydrology and Hydraulics: There was practically no data or information supplied in the files concerning hydrologic and

hydraulic analysis. The data available to the inspection team was not sufficient to access the ability of the spillway to pass flood flows. The location of the spillway in close approximation with the east abutment would appear to reduce the cross sectional area of flow to the east weir, and reduce the overall efficiency. However, the dam has withstood several floods since its completion of 1913.

(2) Embankment: There were no design data for the embankment, just the statistics for the embankment as shown on the construction plans. The embankment cross section appears to be adequate and in accordance with accepted engineering principles and practice. The preparation of the dam site, and the construction of the core wall, downstream toe drains, drilling and grouting of the core trench and construction of the embankment appear to be standard procedures still used in modern day construction of earth dams, and to this date have proven to be adequate for this dam. The absence of a good sod cover on the downstream slope of the dam creates serious doubt about the erodibility of same and yet there appears to be no erosion on the slope. Undoubtedly, overtopping of the dam would be catastrophic, and the sod cover would not be much help if overtopping would occur; but certainly it would aid in erosion of the slope against wind and rainfall.

(3) Appurtenant Structures: A review of the two design drawings indicate that the plans leave much to be desired for construction details. Details of the concrete structures showed very little reinforcing details. All concrete structures appear to be stable in both concept and construction, and have been founded on bedrock. The intake tower employs a bubbling system to keep the ice from forming around the tower, which is formed entirely of concrete. The ladder within the tower appears to be in an advanced state of rust and normally is not used. It is also not enclosed within a safety cage. The outlet conduit, whose primary purpose was control of water during construction, has some leakage which has existed for sometime and probably since it was constructed. As for the spillway walls, it appears that the wall height is insufficient to pass the maximum discharge design flood of 11,900 cfs. The cross sectional area doesn't appear to be large enough.

c. Operating Records

While no formal operating records were available for review at the dam site, regular staff gage readings are made and telephoned to the office of the water company. A call to the Johnstown Water Company was made to obtain the maximum staff gage reading for the flood of 1972 and 1977. No maximum staff gage reading is available for July 1977 other than 92'-6" or normal discharge. For June, 1972, the maximum staff gage reading was 93'-6", or 1'-6" of water

over the weir elevation of 1485. It was noted in the DER files that a memorandum dated March 27, 1936 listed the maximum height of water on the crest at 30 inches on March 18, 1936, with the 30 inch blow-off closed and a 25 inch supply line open. It also noted that 4½ inches of rainfall fell in 24 hours. The rain gage was washed out during the 1977 flood and has already been replaced.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General: The general appearance of this dam and the appurtenance structures are very impressive to the average person because of the height of fill and the cascading flow of water over bedrock to the channel in the valley. However, one soon wonders why there is not a good sod cover on the downstream slope of embankment. Nevertheless, the size of the dam indicates that it must have been designed by some knowledgeable engineer with experience in this type of construction.

b. Dam: The earthen embankment appears to be well maintained. What grass there is growing on the downstream slope was sparce and had not been mowed for a while. It is our understanding the grass is kept mowed by sickle bar while the area below the toe of slope is maintained as a lawn. There was no apparent seepage or wet areas observed on the slope while the stone masonry spring or sump along the lower right toe of slope was discharging clear water from the sand drains under the downstream portion of the dam. The west abutment stone lined drainage ditch running down the slope where the embankment joins the right abutment had a very slight seepage about 20 feet up the embankment, but nothing major. Water appeared between the stones of the ditch but no outward discharge in the ditch. The east abutment between the spillway and embankment showed signs of erosion of the east abutment due to overtopping of the spillway wall during the flood of July 1977. This erosion as well as the erosion of the outlet channel is to be corrected by a construction contract now being prepared by Gannett Fleming Corddry and Carpenter, Inc. There was a very slight depression in the vertical alignment probably due to a construction irregularity. However, it was noted in the dam records that the earthen embankment was supposed to have been constructed 3 feet higher than required so as to take care of settlement or shrinkage. Three 4 inch tile drains were located in the bank of the outlet channel; only two has a slight discharge coming from them. These drains appeared to be coming from the toe area of the left portion of the embankment. There were several wet areas at the toe of the dam near the center. However, there were no evidence of surface cracks or recent sloughing or settlement on the embankment or at the abutment, even though the east abutment was saturated and dripping or running with water coming from the acid mine drainage ditches above the dam and upstream in the pool area. This surface water could be concealing any seepage of water through the east abutment area.

c. Appurtenant Structures: The "bathtub" type ogee weir, spillway walls and channel, the intake tower and the oval shaped conduit appeared to be in relatively good condition and functioning adequately. There were a few questionable areas observed that do not presently affect the operation of the dam. The following is a list of these items:

(1) The "bathtub" spillway projects into the lake very near the east abutment. Due to the narrow opening for the water to approach the eastern weir, we question the efficiency of the eastern weir and how much is the approach water restricted. Also, should an earth slide or the east abutment fail at high water, the results could be complete blockage of this portion of the weir. Such a slide if downstream from the weir could also block the spillway.

(2) The July 1977 flood overtopped the spillway wall and eroded the eastern abutment between the spillway and dam. It appears that the west wall is not high enough; however, the small foot bridge over the spillway was washed out during the flood and could have caused the overtopping. The damages by the 1977 flood are to be corrected this year; however, we are of the opinion that most of the work will be restoring the flood damage areas of the channel and east abutment.

(3) The scour hole at the base of the cascading channel doesn't appear to be wide enough to effect the stability of the dam, but should be protected or reduced in width and then protected from future scour.

(4) The concrete retaining wall at the outlet end of the access conduit is badly spalled and in need of repairs. The stone masonry wall against the right abutment is buldging and ready to fail. The meter and chlorination house is partially blocking this outlet channel.

(5) The downstream channel of the conduit is completely blocked by a earthen embankment with a 6 inch tile drain through it.

(6) The concrete conduit under the dam has a wooden bulkhead at the outlet end, with double doors and a lock. Within the conduit, siltation about 1-2 inches appears to have covered the bottom and appears to be fairly distributed throughout the entire length. At the upstream end of the tunnel, the leakage of the conduit increases more but still not of any great amount. It is estimated that the water flow at one location is about 1/4 inch $\pm$ in diameter. Dam reports indicate the tunnel always did leak, but there were no current reports on the inspection of the conduit.

The amount of silt and the uniformity of it on the invert and slopes of the invert appears to be too much for disposition from infiltration. The distribution is to uniform and regular for the amount of seepage. There appears to be no logical reason for its uniformity and warrants further review.

(7) The concrete intake tower appears to be in fairly good condition, and contains a steel core of riveted plates. The amount of rust on the inside or dry side of the steel core is not known; however, we question the safety of the steel ladder.

(8) The blow-off and drain valve show no signs of leakage. It is noted that there are no records or no one can remember when said drain valve was last opened.

d. Reservoir Area: It was noted that the quality of the water was quite turbid and could be an indication of a sedimentation problem in the reservoir. The overbank areas of the reservoir are relatively steep, with the maximum slope being about 2H to 1V along the right abutment. It was noted in the dam files that in 1957 a permit was to be issued to draw down the dam for removal of an estimated 7 feet of sediments. It is not known whether this was accomplished. All the area adjacent to the reservoir is wooded and at high water the pool would be subject to debris and drift.

e. Downstream Channel: The July 1977 flood completely filled the downstream channel with debris and destroyed the access road and bridge to the dam. The dam operator reported the tailwater resulted in about 5.0 to 5.5 feet of water in the meter house, which would back water up against the western toe of embankment. It is our understanding that a contract is to be let in the near future to restore the downstream channel; however, we do not know the extent of said work.

3.2 Evaluation

The observed condition of the dam and appurtenant structures is considered to be good. The deficiencies observed and discussed have mostly all existed for some time but could have an effect on the safety of the dam. Of primary importance and concern should be the use of the outlet conduit and 30 inch cast iron pipe to reduce the discharge of flood water over the weir and down the spillway. And yet there is no information as to when the tunnel was last used or the valve was operated. The siltation into the conduit is of some concern because fines may be washing out the embankment through the cracks into the conduit.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedure

The only established procedure for operating the dam is to maintain continuity of mine drainage cut-off trenches along the east side of and above the pool elevation and control water quality by use of one or more of the three intakes in the concrete intake tower.

4.2 Maintenance of Dam

The dam embankment is kept mowed by the use of a sicle bar cutter and the area beyond the toe of slope is maintained as a lawn. The downstream slope appears to be acidic by the presence of moss and apparently light turf, yet shows little evidence of erosion. The slope is also protected by several surface drainage ditches. Maintenance of this nature is performed by the dam operator who lives on site, immediately adjacent to tail channel.

4.3 Maintenance of Operating Facilities

Each of the valves are operated at least once a year, except the bottom blow-off at the intake tower. There is no record of this valve being opened the past 15 to 20 years. The ladder in tower appears to be unsatisfactory for access to valves and piping for proper maintenance.

4.4 Warning Systems in Effect

There are no other formal warning systems in effect other than telephone communication from the home of the operator who lives on the site immediately downstream from the dam.

4.5 Evaluation

The dam is maintained by the operator who lives at the site full time. The general appearance of the dam is good, except for obvious damage from the 1977 flood, and for which a consultant has been retained by the water company to prepare plans and specifications for the repairs. There is an area immediately downstream from the masonry box that collects drainage from the dam drains that appears to be saturated from excess or poor drainage of the area or partially blocking of the tile draining the masonry box. Some concern should be given to the build-up of sediments in the outlet conduit, and possible flushing of the conduit and observation of future sedimentation in the conduit.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features

a. Design Data

The hydrologic and hydraulic data available from PennDER for the Salt Lick Dam were very limited. No area-capacity curve, frequency curve, stage-discharge curve, unit hydrograph, design storm, design flood hydrograph, flood routings, or discharge channel capacities were available. Perhaps the age of this dam (65 years) precluded the submission of this information; data such as this was probably not known or used then.

The only hydraulic data available was a maximum spillway discharge capacity of 1,000 cfs per square mile of drainage area. This figure can be extended to 11,900 cfs for the drainage area under consideration. Assuming a coefficient of discharge of 3.8 at the maximum head on the weir, this figure appears reasonable.

b. Experience Data

The Army Corps of Engineers has calculated the PMF for a proposed project to be constructed on Chest Creek in the nearby vicinity of Salt Lick Reservoir. The Chest Creek site has a drainage area of 38 square miles. The Probable Maximum Flood (PMF) peak inflow was calculated to be 65,000 cfs. Transposing this data to the Salt Lick Reservoir by the use of a ratio of the corresponding drainage areas raised to the 0.8 power, results in an estimated PMF peak inflow of 25,700 cfs for the Salt Lick Reservoir. (See Appendix C.)

c. Visual Observations

On the date of the inspection, several members of the inspection team noted the overflow weir appears to be particularly susceptible to restrictions during a flood event. The weir configuration is referred to as a "bathtub" type. Two ogee weirs - one 71 feet long and one 69 feet long - project into the reservoir at a taper that separates them by 30 feet at the dam crest and 10 feet at the end block in the reservoir. The two weirs discharge into a common concrete trough that forms the upstream end of the discharge channel. One weir, the eastern, is extremely close to the shoreline of the reservoir. During a storm event a floating tree and debris could become caught between the weir end block and the eastern shoreline, effectively restricting flow over the eastern weir. A second possibility is the extremely steep slopes forming the eastern shoreline which could become unstable during a

flood event. A resulting earthslide could effectively block the eastern weir. Trees along the eastern embankment felled by a flood event could also cause the same result.

The western weir, while not nearly as prone to restrictions as the eastern weir, could become restricted by trees or other large, floating debris becoming entangled on the weir end block and/or the retaining wall protecting the weir.

d. Overtopping Potential

Comparison of the estimated PMF peak inflow of 25,700 cfs with the estimated maximum spillway capacity of 11,900 cfs, indicates the potential for overtopping of the Salt Lick Reservoir exists. An estimate of the storage effect of the reservoir shows Salt Lick Reservoir does not have the necessary storage available to pass the PMF without overtopping the dam. (See Appendix C.)

e. Spillway Adequacy

The spillway capacity is considered inadequate because it will not pass the PMF without overtopping the dam. One-half the PMF peak inflow into Salt Lick Reservoir would be approximately 12,850 cfs. Comparing this flow with the estimated ultimate spillway capacity of 11,900 cfs indicates the potential for overtopping Salt Lick Dam exists at one-half the PMF. However, if the blow-off valve were opened at the same time, the combined discharges could pass one-half the PMF without overtopping.

An estimate of the storage effect of the reservoir for one-half the PMF shows the Salt Lick Reservoir does not have the storage available that is necessary to pass one-half the PMF without being overtopped (See Appendix C.)

Therefore, the spillway is considered to be seriously inadequate. The elevation differential between the top of the dam and the maximum tailwater elevation during a flood event exceeds 100 feet. The effect of water overtopping the dam could seriously erode the abutment slopes and sparsely vegetated downstream embankment slope, thereby causing the failure of the dam. Failure of this 110-foot high dam impounding 857,000,000 gallons of water at normal pool elevation would be catastrophic. Additional loss of life and extensive property damage in excess of that caused by the maximum tailwater would be a certainty.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

(1) Embankment: The only visual item of concern with respect to the stability of the embankment is the lack of a rating curve for the ogee weir and the spillway. It appears from the field view of the weir that its capacity is greater than the concrete portion of the spillway. And yet the dam has been able to withstand the floods of 1936, 1972, 1975 and 1977. It would seem that, with the pool elevation approaching the top of dam, the spillway walls will most certainly be overtopped, with probable failure of the east abutment and embankment. One would also wonder about the minimal sod cover of probably no more than 40-50%. And yet there is no apparent evidence of surface scour from the runoff. Of concern also is the unexplainable occurrence of a relatively uniform layer of silt in the outlet conduit even in areas where the seepage doesn't occur. We suspect that the silt may have been there for quite some time, even maybe since the conduit was used during construction of the dam, but cannot substantiate this.

(2) Appurtenant Structures: Based on the visual inspection, all appurtenant structures appear to be stable except the right stone masonry wall in the outlet conduit channel. It was also noted that a small portion of the spillway slab appears to have been cracked and washed away.

b. Design and Construction Data

(1) Embankment: There was no design data, soil properties, geology, or slope stability data or information furnished in the files concerning the embankment design and stability for submerged, rapid drawdown and through seepage conditions. However, the ability of the embankment to withstand all floods since its completion in 1913 seems to indicate that good engineering judgement was used for its design and construction.

(2) Appurtenant Structures: There was no design analysis for any of the appurtenant structures, and very minimal amount of details for reinforced concrete. The weir and spillway structures, especially the walls, have the appearance of being gravity structures. However, all structures appear to be stable and structurally adequate.

c. Operating Records: While no formal operating records were available for review at the dam site, it was reported by the dam operator that no major problems have occurred in the years that he has been on the job. The pool elevation records are kept in the Johnstown office of the water company; and specific readings were obtained by telephone request. However, the maximum water level of the dam was recorded in 1972, with no staff gage reading being made in July 1977 other than normal water level. The continuous recorder in the chlorination building is not correlated with the staff gage and working property, and should be replaced.

d. Post-Construction Changes: There have been no reported modifications to the original dam design. Grouting of the outlet conduit was attempted to stop or reduce the amount of seepage in the conduit, as made reference to in the DER records. However, the grouting was only partially successful as per the records.

e. Seismic Stability: The dam is located in Seismic Zone No. 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations, studies, etc. were performed to substantiate or confirm this condition.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety: The visual inspection, operational history and review of all the records as provided by the Pennsylvania Department of Environmental Resources (DER) indicates that the Salt Lick Dam is functioning satisfactory and is in relatively good condition except for the recommendations to be completed. All outward appearance of the embankment and appurtenant structures indicate that sound engineering judgement and good engineering practices were employed in the design of the project, as well as good construction knowhow, even though there seems to be no design computations, or hydrologic and hydraulic analysis available. Of primary concern is the actual capacity of the weir and spillway. To date, the dam has withstood at least three severe floods, with no apparent evidence of overtopping. The DER files indicate that the maximum capacity of the weir is 11,700 cfs with 8 feet of head or the water to elevation 1493, the top of the dam. It is our opinion that the spillway cannot discharge such a flow or even 50% of such a flow. The hydrologic and hydraulic procedures used during this inspection indicated that the spillway would not pass the PMF prior to the dam being overtopped; or the reservoir will not be able to contain one-half the PMF without being overtopped.

b. Adequacy of Information: The information that was available during the inspection was not considered sufficient to make a reasonable assessment of the project; but the age of the dam and years of continuous trouble-free service is indicative of the apparent quality of the facilities.

c. Urgency: It is considered that the recommendations suggested below be implemented as soon as practical.

7.2 Recommendations/Remedial Measures

a. Facilities: In order to assure the continued safe operation of the Salt Lick Dam, the following actions are recommended:

(1) The Owner retain a competent engineer to make a complete hydrologic and hydraulic study and analysis of the Salt Lick Dam to determine the capacity of the ogee weir and spillway and the Probable Maximum Flood. The study could include recommendations on how to increase the safety of the dam, should the outlet facilities prove to be too inadequate. Such a study should also include a centerline profile of the top of the dam and spillway and outlet channel.

(2) The Owner initiate a method of determining if the 30 inch blow-off value and discharge pipe is operative and can be used to help control the discharge over the spillway during times of emergency.

(3) The Owner initiate a program to make the minor repairs to the end of the weir and the walls of the conduit outlet channel, and improve the flow characteristics of said outlet channel around the meter and chlorination building.

(4) The Owner remove the roadway or ramp fill from the conduit outlet channel, or if said roadway or ramp is required, an adequate waterway opening be provided before the embankment is reconstructed.

(5) The Owner should investigate the degree of deterioration of the intake tower ladder and other steel members therein, and prepare the necessary plans and specifications to repair them.

(6) The Owner should investigate the grouting of the outlet conduit so as to stop or reduce the leakage to a minimum; cleanout the silt in the conduit and observe the amount of siltation that takes place, if any, over a period of time.

(7) The Owner install a trash boom upstream from the spillway for protection of and more efficient operation of the weir.

(8) The Owner retain a competent engineer to investigate the slope stability of the east abutment above the weir and spillway.

(9) The Owner investigate the installation of piezometers, and a program be adopted to read and record piezometer readings and to establish a monitoring program for determination any changes in water pressures within the embankment, and in the area immediately downstream.

b. Operation and Maintenance Procedures: Even though the dam is maintained in good condition, it is recommended that the following items be attended to as soon as possible:

(1) The continuous water recorder in the meter house be repaired or replaced for a continuous stage record of the pool.

(2) The Owner develop a formal written warning system in the event of an emergency, including an around the clock surveillance during periods of prolonged high precipitation and heavy runoff for early detection of problems.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Salt Lick Dam

ID # 436 (DER 11-8)

ITEM	REMARKS
AS-BUILT DRAWINGS	Drawings as furnished are "as built." Only two plans of the dam are available, are old blueprints and in poor condition.
REGIONAL VICINITY MAP	Project shown on Nanty Glo, Pennsylvania Quadrangle Sheet N 4022.5 - W 7845/7.5 dated 1964 and photorevised 1972.
CONSTRUCTION HISTORY	A few construction reports describing construction details furnished.
TYPICAL SECTIONS OF DAM	General section of dam available.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	No rating curve available.
RAINFALL/RESERVOIR RECORDS	Should be available with rain gage at dam.

ITEM	REMARKS
DESIGN REPORTS	No design reports or information available.
GEOLOGY REPORTS	No geological reports provided although a report by Farley Gannett, Engineers, reported core wall carried into bedrock and "into this fireclay" holes were drilled and grouted.
DESIGN COMPUTATIONS	None
HYDROLOGY & HYDRAULICS	None
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	None
BORING RECORDS	
LABORATORY	
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	"Report Upon The Salt Lick Dam" by Francis B. McDowell, Jr.
BORROW SOURCES	Unknown, although the few construction pictures seem to indicate that the soils were washed of the slopes and highlands for the hydraulic fill.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None observed.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Report listed under Post - Construction Survey of Dam.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None available for review.

ITEM	REMARKS
SPILLWAY PLAN	Included on Construction Plans.
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	None available.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Highland - farm land/steep sloped valley

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1485 (2630 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1493 (3190 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 1490.5 (approximately)

ELEVATION TOP DAM: 1493.0

CREST:

a. Elevation 1485
b. Type Bathtub type spillway
c. Width Variable
d. Length 140 feet
e. Location Spillover East abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type Oval shaped (10' x 9') concrete conduit
b. Location West abutment
c. Entrance inverts 1397+
d. Exit inverts 1370+
e. Emergency draw down facilities Gate valve & 30 inch outlet pipe

HYDROMETEOROLOGICAL GAGES:

a. Type Rain gage
b. Location Downstream from toe of dam
c. Records None observed

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

APPENDIX B

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase I

Name Dam Johnstown Water Authority (Salt Lick Dam) County Cambria State Pennsylvania ID # 436 (DER 11-8)

Type of Dam Earth Fill (Hydraulic) Hazard Category 1

Date(s) Inspection 4/4/78 Weather Partially Cloudy Temperature 60°+

B-1

Pool Elevation at Time of Inspection 1485.1+ M.S.L. Tailwater at Time of Inspection 1380± M.S.L. (estimated)

Inspection Personnel:

Robert C. Tomlinson, P.E.
R. Lynn Young
Tim Mikolic - Dam Operator
John B. Smilnak, P.E.
R. Eric Critchfield, P.E.
Dennis M. Stidinger

Robert C. Tomlinson Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None visible.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None visible.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Some erosion on left or east abutment slope due to flood of July, 1977.	Erosion to be repaired in near future when contract is to be let for repair of storm damage of July 1977.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal & vertical alignment of dam good except for some minor vertical swale for entire length.	It has been reported that the top of embankment was constructed 3'$\pm$ high to allow for vertical settlement.
RIPRAP FAILURES	General condition of riprap good.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Both upstream & downstream slopes in good condition. Drainer breakers in good condition.	Appears difficult to grow turf on downstream slope due to carbonaceous shale, subsoil, etc.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junction of embankment and abutments good. No apparent settlement and only very minor seepage along lower right junction.	
ANY NOTICEABLE SEEPAGE	Slight seepage along lower right abutment and right toe of slope.	
STAFF GAGE AND RECORDER	Staff gage on spillway and intake tower. With dam full, tower gage reads 92.25'.	
DRAINS	3 - 4 inch tile drains exposed in discharge channel, with only 2 showing signs of discharge. Masonry sump at toe of right center embankment appears to be collection point for sand drains. All drainage clear; no evident of silt.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Water leaking at construction joints in conduit. One stream 50-75' downstream from tower is 1/4"± diameter. Old pipe in roof indicates possible grouting of conduit to stop leakage.	Leakage may be cause of 1-2" sediment accumulation in conduit. Possibility of past or present piping. Distribution of sediments fairly uniform.
INTAKE STRUCTURE	Crack on south side of intake tower (vert.). Steel riveted core of steel plates with apparent rust on dry side (inside). Also apparent corrosion of ladder; safety questionable.	Deterioration of ladder, bolts should be checked and replaced or repaired.
OUTLET STRUCTURE	Seepage within 50-75 feet of tower greater than downstream portion with increased amount of sediments on floor of conduit. Downstream end of conduit boarded up, with double doors.	Check for grouting requirements, maybe chemical grout. Operation of valves questionable.
OUTLET CHANNEL	Concrete wall on right deteriorating; left wall constructed of stone masonry about ready to fall down at one location. Channel obstructed by valve house and earthen ramp with 6" drain tile; could cause backwater in chlorination building.	Walls need repaired and earthen embankment removed from channel.
EMERGENCY GATE	Blowoff and drain valve or gate shows no sign of leaking. Questionable when it was last opened, if ever.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete weir in apparent good condition; some superficial cracking of gunite. Upstream "plug" of weir needs repaired.	Install trash boom upstream to catch floating debris.
APPROACH CHANNEL	No approach channel; however left weir of spillway relatively close to east upstream abutment.	Left weir could be blocked by floating debris or small landslide.
DISCHARGE CHANNEL	No weep holes in walls. Right wall pressure mortared concrete; left wall is bedrock. Wall overtopped by July, 1977 flood due to bend in channel and insufficient wall height. Channel bottom paved. Sharp bend at end of paved channel, same in bedrock.	Channel appears to be to narrow and walls should be raised to prevent further overtopping and scouring of east abutment.
BRIDGE AND PIERS	Footbridge across channel washed out in July, 1977 flood due to build-up of debris on upstream side.	Walls and bridge should be raised. Bridge to be replaced this year.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	No apparent monumentation.	
OBSERVATION WELLS	None	
WEIRS	Bathtub type weir with water flowing over opposite faces. Weirs discharge into U-shaped trough that widens out on downstream end.	Question efficiency of weir and calibration of same due to shape.
PIEZOMETERS	None	
OTHER	Water depth gage in chlorine building although it reads different than staff gage by 10' ±.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Upstream slopes relatively steep, with east slope carrying drainage ditches and pipes of acid mine waste around reservoir. Slope saturated due to leakage of system and could be a potential slope problem.	Drainage ditches for acid waste should be repaired.
SEDIMENTATION	Water exhibits high turbidity but could not determine if any extensive sedimentation.	
OPERATIONAL PROCEDURES	Operations generally consist of maintaining chlorinator and supply; patrolling mine drainage channel and cut-off stream at three elevations above reservoir on east slopes; operation of the two upper intakes in tower; checking seepage, collection of water samples and other routine housekeeping. No information obtained on when the blow-off valve was last used or opened.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Channel from end of spillway badly eroded by July, 1977 flood. Water cascading down bedrock channel has eroded a hole in bottom of channel at least 100 feet wide. Evidence of scour hole already made by past flood.	Scour of outlet channel doesn't seem to affect stability of dam.
SLOPES	All slopes and overbank washed out in flood of 1977.	Channel slopes should be rip-rapped. Repairs to outlet channel to be performed this year.
APPROXIMATE NO. OF HOMES AND POPULATION	Numerous homes and extensive population downstream from dam.	

APPENDIX C

HYDROLOGY/HYDRAULICS

BY LEG DATE 4/78 | DAM SAFETY INSPECTION | SHEET NO. 1 OF 1
CHKD. BY ____ DATE ____ | DETERMINATION OF PMF, PEAK INFLOW | JOB NO. ____
____ | SALTLICK DAM | CONTRACT NO. ____

HAZARD CLASSIFICATION : HIGH
SIZE " : LARGE
DRAINAGE AREA = 11.9 MI^2

NO UPSTREAM IMPOUNDMENTS

RECOMMENDED SDF = PMF

MAX. SPILLWAY CAPACITY = 1000 CFS/MI^2 x 11.9 MI^2 = 11,900 CFS*

TO ESTIMATE PMF PEAK INFLOW, TRANSPOSE DATA FOR CHEST CREEK DAM.

CHEST CREEK DAM - DRAINAGE AREA (D.A.) = 38 MI^2

SPILLWAY DESIGN FLOOD (PMF) PEAK INFLOW = 65,000 CFS

USING 0.8 RULE TO TRANSPOSE DATA TO SALTLICK DAM

$$\left(\frac{D.A._{SALT.}}{D.A._{C.CK}}\right)^{0.8} = \frac{PMF_{SALT.}}{PMF_{C.CK.}}$$

$$\left(\frac{11.9}{38.0}\right)^{0.8} = \frac{PMF_{SALT}}{65{,}000\ CFS} \Rightarrow PMF_{SALTLICK} = 25{,}676$$

USE $PMF_{SALTLICK}$ = 25,700

$PMF_{SALTLICK}$ = 25,700 > 11,900 SPILLWAY CAPACITY

∴ DETERMINE STORAGE EFFECT OF RESERVOIR

* From Pennsylvania Department of Environmental Resources files on the Salt Lick Dam

SF 10931A

SURFACE AREA @ NORMAL POOL EL. OF 1485.0 = 67 AC.
SURFACE AREA @ MAX. POOL EL. OF 1493.0 = 76 AC.

STORAGE AVAILABLE ABOVE NORMAL POOL EL.

$= \frac{(67+76)}{2} \times 8' = 572$ ACRE-Ft.

USING SHORTCUT METHOD SUGGESTED BY NAD

MAXIMUM SPILLWAY DISCHARGE = 11,900 CFS
PMF PEAK INFLOW (Q_{IMAX}) = 25,700 CFS

$$P = \frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{11,900}{25,700} = .46$$

$$\therefore (1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{VOLUME OF INFLOW HYDROGRAPH}} = .54$$

VOLUME OF INFLOW HYDROGRAPH (V)

Assuming a triangular shape

Total Time (T) = 30 Hrs. (From plot of total time vs drainage area (D.A.) for D.A. = 11.9 MI^2 and drainage basin assumed to be in nearby and geographically steeper Susquehanna River Basin, Region 1.)

$$V = \tfrac{1}{2}(Q_{IMAX})(T) = \tfrac{1}{2}(25,700\ CFS)(30\ HR)\left(\frac{acre}{43,560\ ft^2}\right)\left(\frac{3600\ sec}{Hr}\right)$$

V = 31,860 ACRE-Ft

REQUIRED RESERVOIR STORAGE = .54(31,860)
= 17,200 ACRE-Ft

STORAGE AVAILABLE = 572 ACRE-Ft < 17,200

∴ SALTLICK RESERVOIR WILL NOT BE ABLE TO CONTAIN THE PMF WITHOUT BEING OVERTOPPED.

CHECK STORAGE EFFECT @ 1/2 PMF

1/2 PMF = 1/2 x 25,700 = 12,850 CFS

$P = \frac{11,900}{12,850} = .93$

∴ (1-P) = .07

VOLUME OF INFLOW HYDROGRAPH (V)

Assuming a Triangular Shape

$V = 1/2\ (12,850\ cfs)(30\ Hr.)\left(\frac{acre}{43,560\ ft^2}\right)\left(\frac{3600\ sec}{Hr.}\right)$

V = 15,930 ACRE-Ft

REQUIRED RESERVOIR STORAGE = .07 (15,930)

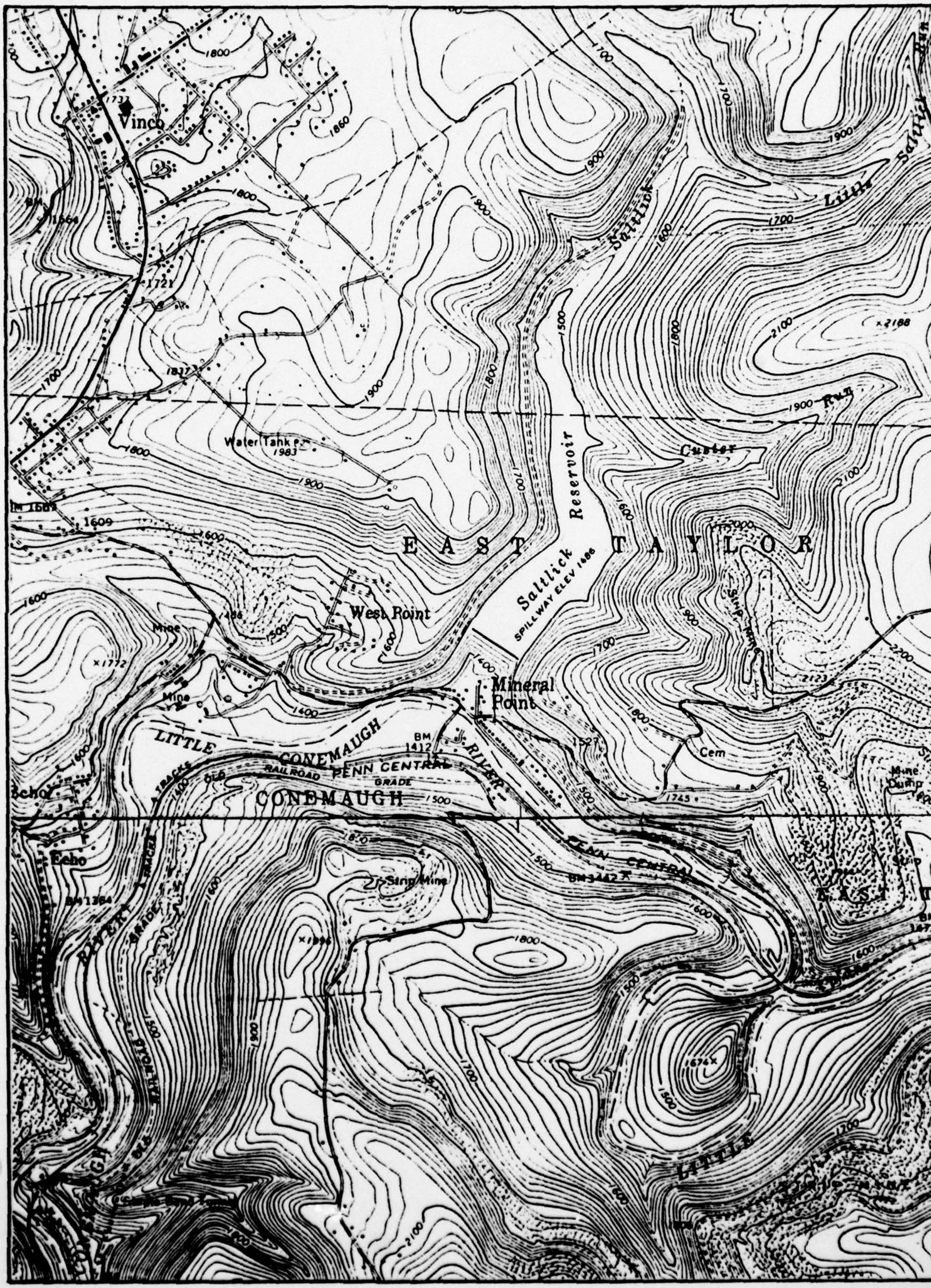
= 1115 ACRE-Ft

STORAGE AVAILABLE = 572 ACRE-Ft < 1115

∴ SALTLICK RESERVOIR WILL NOT BE ABLE TO CONTAIN 1/2 THE PMF WITHOUT BEING OVERTOPPED.

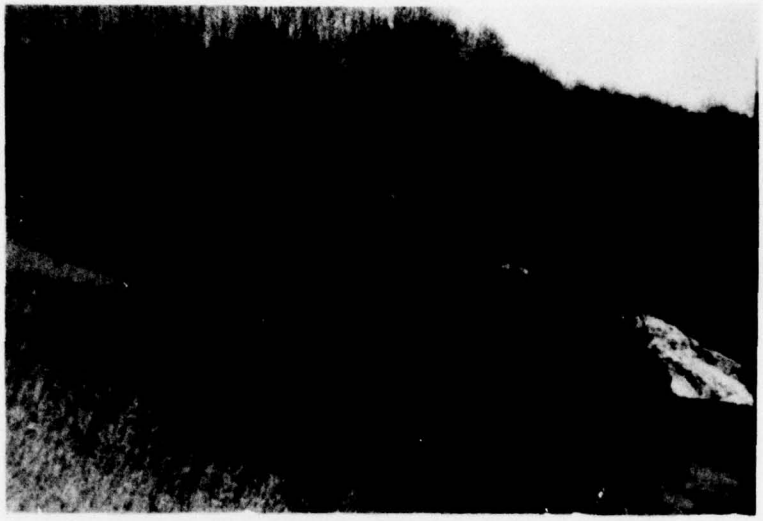
APPENDIX D

PHOTOGRAPHS


Vinco
West Point
Mineral Point
Water Tank
Saltlick Reservoir
Saltlick
SPILLWAY ELEV 1666
EAST TAYLOR
Little Saltlick Run
Custer Run
LITTLE CONEMAUGH RIVER
PENN CENTRAL
RAILROAD GRADE
CONEMAUGH
Echo
Mine
Strip Mine
Cem
Mine Dump
LITTLE

VIEW OF TOP OF DAM, LOOKING SOUTHEAST

VIEW OF DOWNSTREAM SLOPE OF DAM

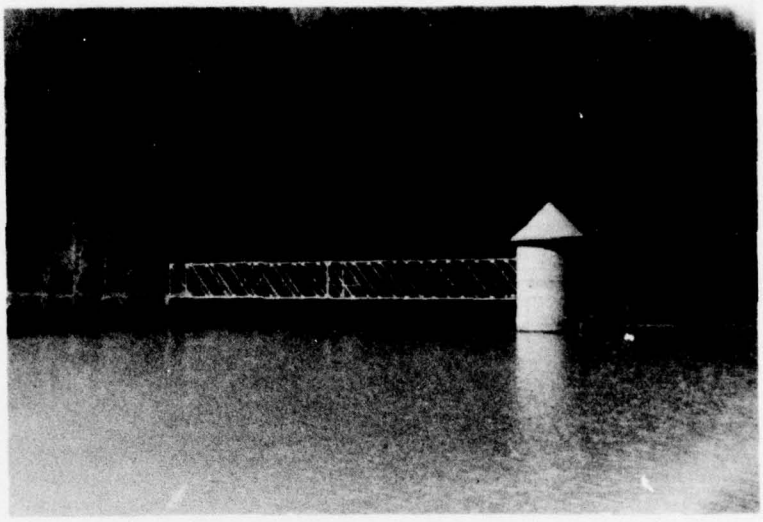


VIEW SHOWING EASTERN DOWNSTREAM ABUTMENT
AND OUTLET CHANNEL. UPPER FLOW FROM MINES

SCOUR AT BOTTOM OF DAM OUTLET CHANNEL
FROM FLOOD OF JULY, 1977

VIEW OF CONTROL HOUSE AND DAM CONDUIT

GENERAL VIEW OF WEIR AND SPILLWAY

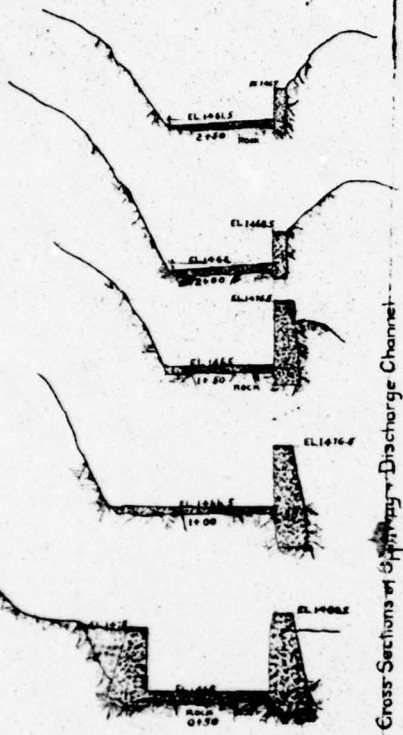


VIEW OF DAM INTAKE TOWER AND BRIDGE

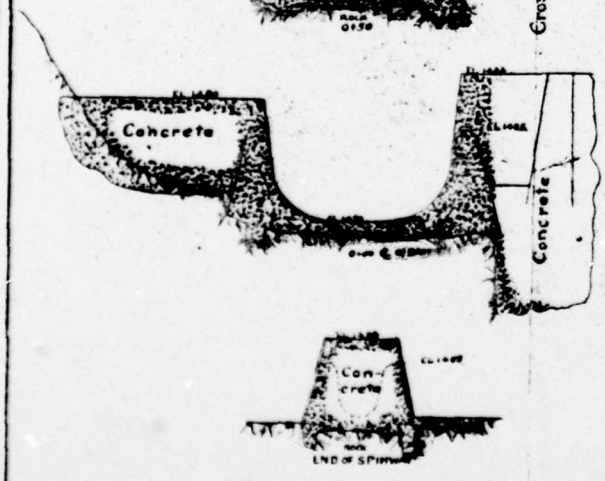
VIEW OF DAM OUTLET CHANNEL. NOTE
SCOUR FROM FLOOD OF JULY, 1977

APPENDIX E

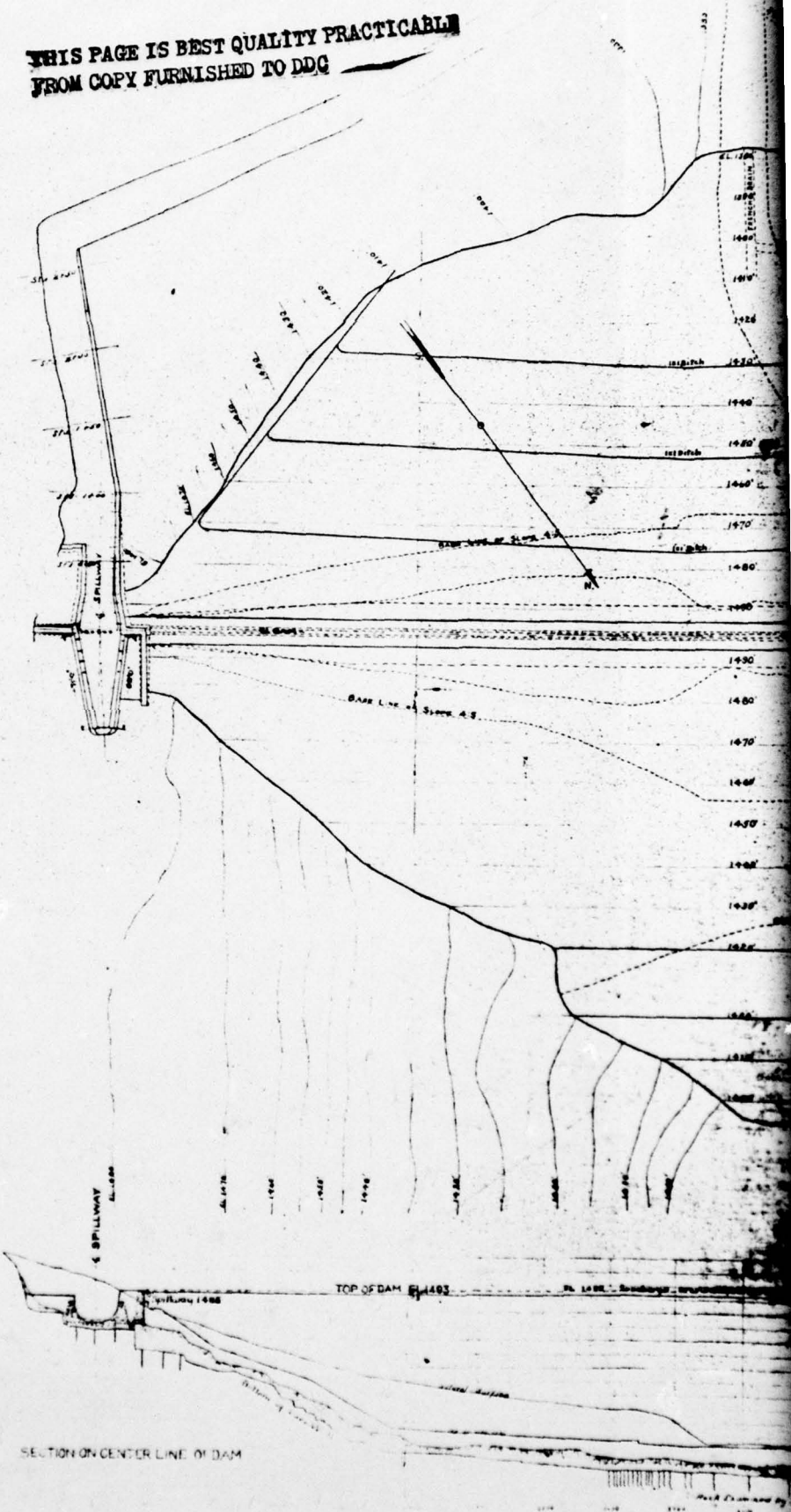
DRAWINGS

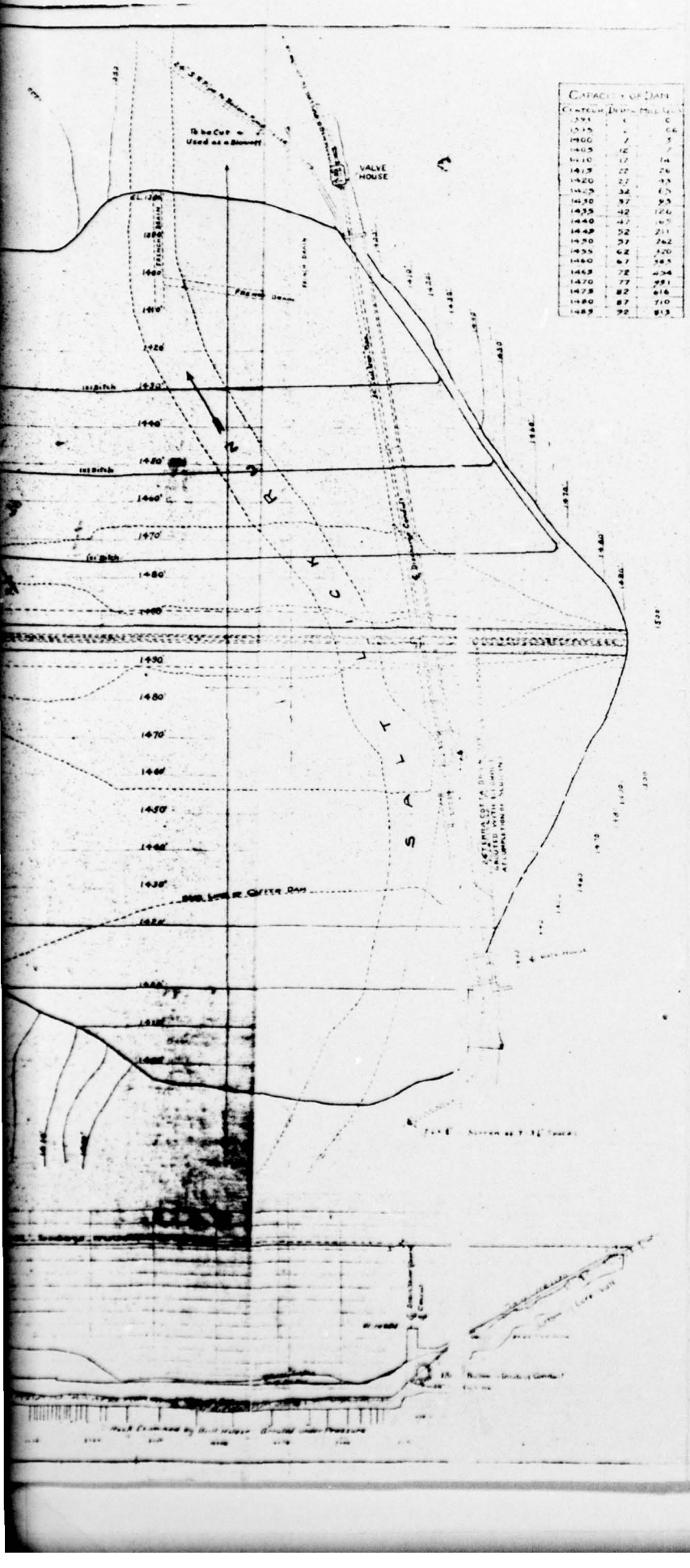


Cross Sections of Spillway - Discharge Channel
Scale 1"=10'



STATE OF PENNSYLVANIA } SS
CITY OF JOHNSTOWN }
WE HEREBY CERTIFY THAT THIS IS
A CORRECT PLAN OF THE
SALT LICK DAM
JOHNSTOWN WATER CO.





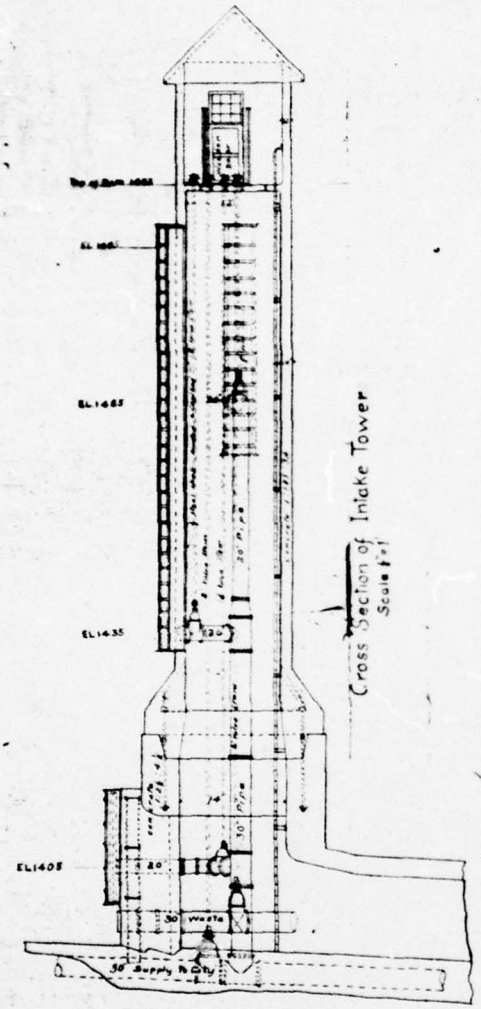
CROSS SECTION THRU STATION 4+00

JOHNSTOWN WATER CO.

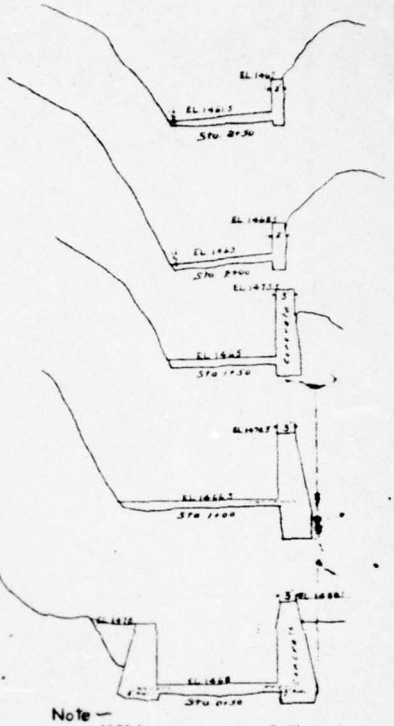
DETAIL PLAN

SALT LICK DAM

BUILT March 8 1913

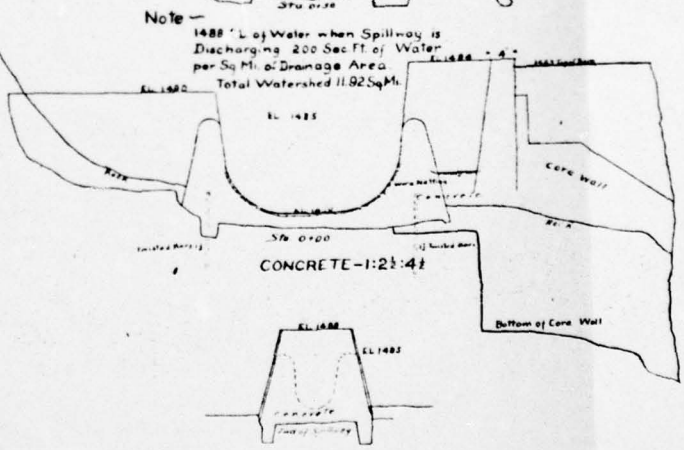


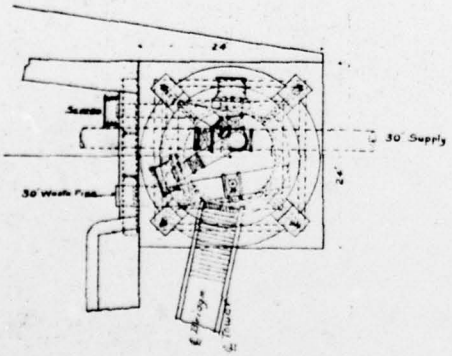
Cross Section of Intake Tower
Scale 1"=1'



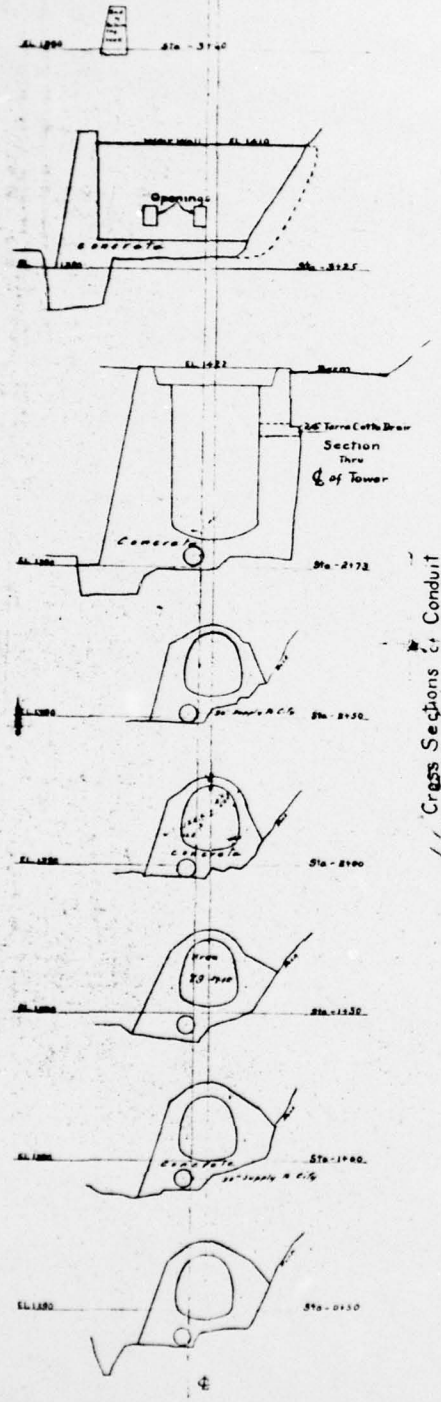
Cross Sections of Spillway + Discharge Channel
Scale 1"=10'

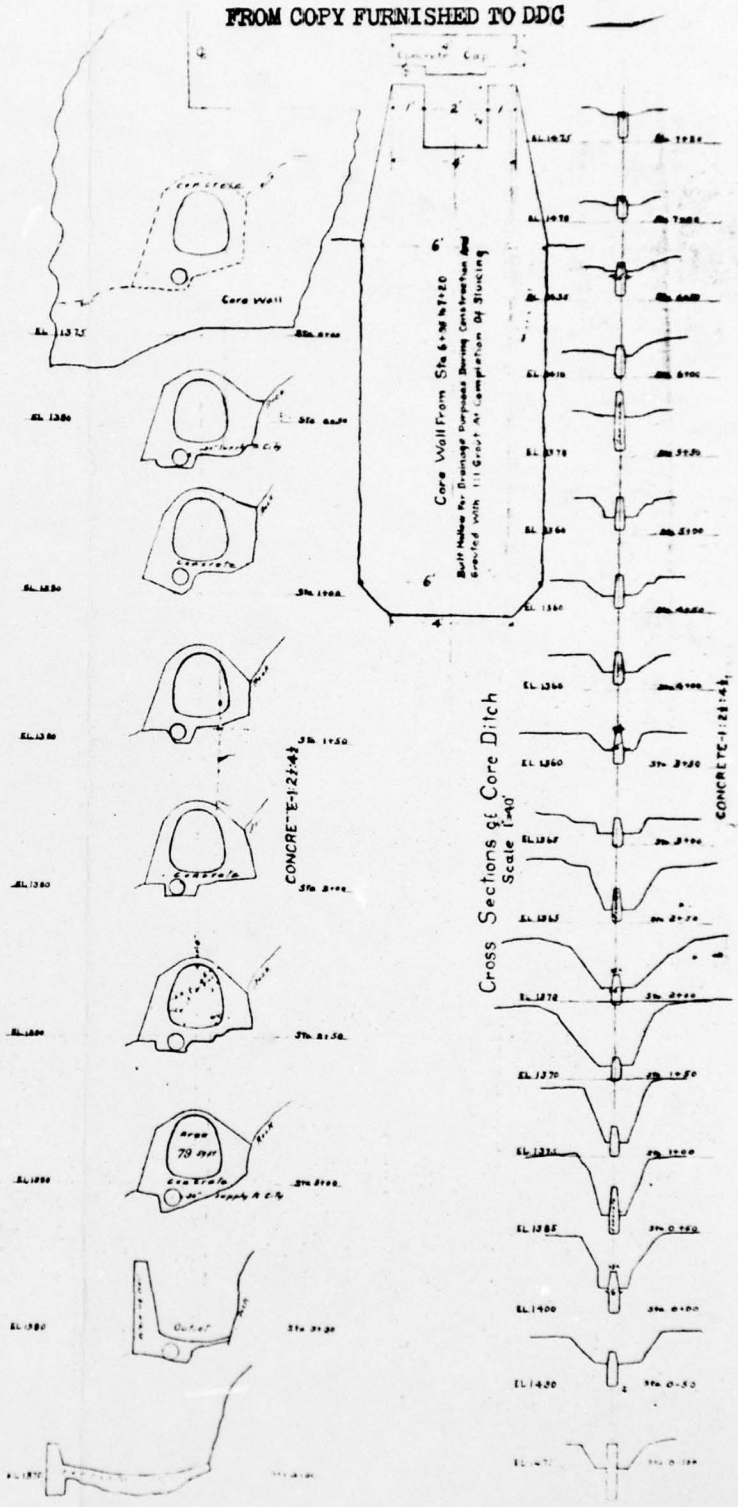
Note —
1488 'L of Water when Spillway is
Discharging 200 Sec Ft of Water
per Sq Mi of Drainage Area
Total Watershed 11.92 Sq Mi.





STATE OF PENNSYLVANIA } SS
CITY OF JOHNSTOWN
WE HEREBY CERTIFY THAT THIS IS
A CORRECT DETAIL PLAN OF
SALT LICK DAM
JOHNSTOWN WATER CO
BY [signature] PRESIDENT
ATTEST [signature] SECRETARY
DATED
CORRECT ATTEST
[signature]
CONSULTING ENGINEERS
DATE June 1 1914





JOHNSTOWN WATER CO.
SALT LICK DAM

APPENDIX F

MISCELLANEOUS

GEOLOGY

The project is located in the Appalachian Plateau Province a short distance west of the Allegheny Front. The region is characterized by generally hilly terrain composed of broad, rounded divides of concordant altitude from which the surface descends rapidly to streams having little bottom land.

The surface formations of the area are entirely of sedimentary origin consisting of Mississippian and Pennsylvanian Age strata. The project area is underlain by rocks of the Mauch Chunk Formation, Pottsville Formation and Allegheny Group. The Mauch Chunk consists primarily of olive and red shales with a few minor interbedded sandstones. These sandstones are frequently olive colored and are generally laminated and cross-bedded. The Pottsville rocks unconformably overlie the Mauch Chunk. The rocks of the Pottsville consists generally of two principal sandstone members with one interval of coal, shale, and flint clay between. The Allegheny Group which overlies the Pottsville is a highly variable series of alternating shales and sandstones with several workable coal beds and their accompanying underclays. Locally, the Allegheny Group averages about 270 feet in thickness and contains seven workable coal seams.

Structurally, the project area lies on the western limb of the Ebensburg Anticline. The strata strikes approximately N 25° E. and dips are quite variable ranging from about 1.5% to nearly 5.0%+ to the west.

A series of red and olive shales outcrop in the spillway of the dam. These shales are extremely friable and weather in blocks due to some well developed joint patterns. A sandstone unit outcrops on the hillside above the discharge spillway. This sandstone also has a well developed joint system causing it to break off in blocks, threatening to slide downslope into the spillway area. Coal was mined at several horizons in the hillside to the east of the reservoir. Several of these drifts are discharging a considerable flow of acid mine drainage, most of which is conveyed around the reservoir by a series of diversion channels.